

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-220242

(43)Date of publication of application : 09.08.1994

(51)Int.Cl.

C08J 9/40

(21)Application number : 05-026080

(71)Applicant : SHIN ETSU CHEM CO LTD

(22)Date of filing : 21.01.1993

(72)Inventor : TAKAMURA TORU

TOMARU KAZUHIKO

MATSUMURA MASAOKI

(54) CUSHIONING MATERIAL

(57)Abstract:

PURPOSE: To improve the cushioning and shape-following properties of a flexible three-dimensional network or foam body having interconnecting pores by coating the surface of the skeleton lattice of the body with a silicone bouncing putty.

CONSTITUTION: A silicone bouncing putty is obtd. by polymerizing 10-90 pts.wt. dimethylsiloxane having both terminals alkoxylated and a viscosity at 25°C of 1-1,000cSt, 90-10 pts.wt. dimethylsiloxane having both terminals hydroxylated and a viscosity at 25°C of 1-15cSt, 0.1-15 pts.wt. boric acid, and 0-20 pts.wt. colloidal silica at 140-150°C for 2-10hr. A flexible three-dimensional network or foam body having interconnecting pores is immersed in a soln. of 100 pts.wt. silicone bouncing putty in 20-400 pts.wt. solvent and dried at room temp. to 100°C for 2min to 1 day to coat the surface of the skeleton lattice of the body with the putty, giving a cushioning material having a specific gravity of 0.1-0.8.

LEGAL STATUS

[Date of request for examination] 29.06.1995

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]	2586285
[Date of registration]	05.12.1996
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

(19)日本国特許庁(JP)

(12)公開特許公報(A)

(11)特許出願公開番号

特開平6-220242

(43)公開日 平成6年(1994)8月9日

(51)IntCl⁵

C 0 8 J 9/40

識別記号

庁内整理番号

F I

技術表示箇所

7310-4F

審査請求 未請求 請求項の数 2 FD (全 4 頁)

(21)出願番号

特願平5-26080

(22)出願日

平成5年(1993)1月21日

(71)出願人 000002060

信越化学工業株式会社

東京都千代田区大手町二丁目6番1号

(72)発明者 高村 聡

東京都千代田区大手町二丁目6番1号 信

越化学工業株式会社内

(72)発明者 都丸 一彦

群馬県碓氷郡松井田町大字人見1番地10

信越化学工業株式会社シリコン電子材料

技術研究所内

(74)代理人 弁理士 小島 隆司

最終頁に続く

(54)【発明の名称】 衝撃緩衝材料

(57)【要約】

【構成】 内部連通空間を有する可撓性の三次元網状体又はフォーム体の骨格格子表面を覆ってシリコンバンシングパテでコーティングしてなることを特徴とする衝撃緩衝材料。

【効果】 本発明の衝撃緩衝材料は、穏やかな応力に対してはスムーズに変形し、これに追従すると共に、応力を取り除くと緩やかに原形に回復し、また、所定量以上の応力がかかったときには最小の変形で応力を緩和し、しかも軽量で所望の形状に形成することが容易で安価な衝撃緩衝材料となり、椅子、ヘルメット等の保護具などの衝撃緩衝性を付与する用途に好適なものである。

【特許請求の範囲】

【請求項1】 内部連通空間を有する可撓性の三次元網状体又はフォーム体の骨格格子表面を覆ってシリコーンバンシングパテでコーティングしてなることを特徴とする衝撃緩衝材料。

【請求項2】 上記三次元網状体又はフォーム体が連続気泡性のプラスチックフォームである請求項1記載の衝撃緩衝材料。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、形状追随性が良好であり、かつ衝撃緩和性に優れ、このため椅子、ヘルメット等の保護具などに好適に用いられる衝撃緩衝材料に関する。

【0002】

【従来の技術及び発明が解決しようとする課題】従来、椅子、ヘルメット等の保護具などの衝撃緩衝材料としてプラスチックフォーム、エアーマット、ゲル、パテなどが使用されている。しかし、プラスチックフォームやエアーマットは軽く、また変形性、形に対する追従性に優れている反面、強い衝撃力がかかると容易に変形し、緩衝性を十分に発揮し得なくなる問題がある。一方、ゲルやパテは比較的強い衝撃力に対しても十分な衝撃緩衝性を有するが、軽量化に問題がある。

【0003】そこで、ゲルやパテの軽量化を図ったものとして、例えば特開昭62-159601号公報において、ゲルに微小中空体を混入した衝撃緩衝材料、特開平4-117974号公報において、バンシングパテに弾性微小中空体を混入した衝撃緩衝材料が提案されている。

【0004】しかしながら、これらの提案に係る衝撃緩衝部材は、形に対する追従性が不十分であったり、例えばヘルメットに装着しようとする場合、特別の包装を必要とするので高価なものになってしまったり、更に所望形状に形成する場合、形状に制限があるなどの問題がある。

【0005】本発明は上記事情に鑑みなされたもので、軽量でかつ形に対する追従性が良好であると共に、所定値以上の衝撃力がかかったときにも最小の変形で応力を緩和することができ、しかも所望の形状に形成することが可能な衝撃緩衝材料を提供することを目的とする。

【0006】

【課題を解決するための手段及び作用】本発明者は、上記目的を達成するため鋭意検討を行った結果、連続気泡構造のプラスチックフォームなどの内部連通空間を有する可撓性の三次元網状体又はフォーム体をシリコーンバンシングパテの溶解液で含浸処理し、乾燥させるなどの方法で、上記網状体又はフォーム体の骨格格子表面を覆ってシリコーンバンシングパテのコーティング層を形成することによって得られる衝撃緩衝材料は、上記内部連

通空間を保持した状態で、軽量である上、形に対する追従性が良好であると共に、強い衝撃力がかかった場合にもその応力を十分にしかも確実に緩和することができ、衝撃緩衝性に優れ、また容易に所望の形状に形成し得ることを知見し、本発明をなすに至った。

【0007】従って、本発明は、内部連通空間を有する可撓性の三次元網状体又はフォーム体の骨格格子表面を覆ってシリコーンバンシングパテでコーティングしてなることを特徴とする衝撃緩衝材料を提供する。

【0008】以下、本発明を更に詳述すると、本発明の衝撃緩衝材料は、内部連通空間を有する可撓性の網状体又はフォーム体を基体とするものである。

【0009】ここで、網状体又はフォーム体としてはポリエチレン、ポリスチレン、ポリ塩化ビニル、ポリウレタン、フェノール樹脂、ユリア樹脂、メタクリル樹脂、シリコーン樹脂の連続気泡構造のプラスチックフォーム、海绵、コルク等の多孔性天然物質、織布や不織布等の繊維状物質からなる多孔性物質などが挙げられる。この中では連続気泡構造のプラスチックフォーム、なかでもポリウレタンフォーム及びシリコーンフォームが好ましく、特に可撓性のある軟質のポリエーテルポリウレタンフォーム及びポリエステルポリウレタンフォームが種類も豊富であり、好適に使用することができる。

【0010】上記内部連通空間の直径或いはプラスチックフォームである場合そのセル数は特に制限されるものではないが、ポリウレタンフォームの場合、後述するシリコーンバンシングパテ溶解液を含浸する際の含浸性の点から、その比重を0.03～0.08とすることが好ましい。また、同様の理由から、シリコーンフォームの場合は、その比重を0.1～0.5とすることが好ましい。

【0011】シリコーンバンシングパテは、ほう素原子を含むシロキサンからなるものであり、例えば特公昭26-6944号公報に記載されている製造方法によって得ることができる。具体的には、25℃における粘度が1～1,000センチストークス(cst)の両末端アルコキシ基を有するジメチルシロキサン10～90部(重量部、以下同じ)に25℃における粘度が1～10,000cstの両末端ヒドロキシ基を有するジメチルシロキサン90～10部、ほう酸0.1～15部、コロイダルシリカ0～20部を例えばニーダー中で140～150℃において2～10時間重合することによって得ることができる。

【0012】なお、このシリコーンバンシングパテは、徐々に伸ばしていくと水あめのように伸び、これにハンマーなどによって衝撃を与えるとガラスのように割れ、放置すると次第に変形して平板状になってしまうものであり、ラバーボールよりも良く弾む性質を有するものである。

【0013】この場合、シリコーンバンシングパテを溶

解する溶媒としてはアルコール類、エステル類、ケトン類、炭化水素類、ハロゲン化炭化水素類などの極性溶媒を用いることができ、シリコーンバンシングパテの溶解性の点から、特に酢酸エステル等のエステル類、メチルエチルケトン、メチルイソブチルケトン等のケトン類が推奨される。

【0014】シリコーンバンシングパテに対するこれらの溶媒の使用量は、シリコーンバンシングパテ100部に対して20～400部とすることが好ましい。

【0015】このような溶解液をプラスチックフォーム等の上記網状体又はフォーム体中含浸させ、網状体又はフォーム体の骨格格子表面にシリコーンバンシングパテのコーティング層を形成する場合は、この網状体又はフォーム体上記溶解液を浸漬することによって上記網状体又はフォーム体の内部連通空間に上記溶解液を充分に含浸させた後に引上げ、余分な溶解液をロールで絞り取るという方法、網状体又はフォーム体が薄物であれば両面上記溶解液をロールコーター、ナイフコーター等により充分に塗布する（塗布により網状体又はフォーム体の内部に上記溶解液が含浸される）という方法を採用し、次いで、室温～100℃で2分～1日乾燥させることによって本発明の衝撃緩衝材料を得ることができる。

【0016】この場合、シリコーンバンシングパテのコーティング量は、衝撃緩衝材料の用途に応じて決めることができるが、一般的には、上記乾燥後の衝撃緩衝材料の比重が0.1～0.8の範囲となるような量とすることが好ましい。この比重が0.1未満ではシリコーンバンシングパテの形成量が少なすぎるため、充分な衝撃緩衝効果が得られない場合があり、この比重が0.8を超えると衝撃緩衝材料を装着した物品の軽量化が十分に成されない場合がある。

【0017】以上のようにして得られた衝撃緩衝材料は、穏やかな応力に対してはスムーズに変形し、これに追従すると共に、応力を取り除くと緩やかに原形に回復し、また、所定量以上の応力がかかったときには最小の変形で応力を緩和し、しかも軽量で所望の形状に形成することが容易で安価な衝撃緩衝材料となり、このため椅子、ヘルメット等の保護具などの衝撃緩衝性を付与する用途に好適なものである。

【0018】

【実施例】以下、実施例と比較例を示し、本発明を具体的に説明するが、本発明は下記の実施例に制限されるも

のではない。

【0019】【実施例1～6、比較例1～6】まず、25℃における粘度が10センチストークスの両末端エトキシ基を有するジメチルシロキサン70部に上記と同様の粘度の両末端ヒドロキシ基を有するジメチルシロキサン30部、ほう酸5.5部、コロイダルシリカ3部をニーダー中で140～150℃で4時間重合し、シリコーンバンシングパテを得た。次いで、このシリコーンバンシングパテ100部に酢酸エチル100部を加え、ミキサーにて溶解し、含浸液を調製した。

【0020】表1に示すウレタンスポンジ（株）イソアックコーポレーション製、MFシリーズのポリウレタンフォーム、縦5cm、横5cm、厚さ1cm）に2本ロールによりロール間隔5mmで上記含浸液を含浸し、室温に3時間放置し、次いで80℃で30分間乾燥することにより衝撃緩衝材料を得た。

【0021】これら衝撃緩衝材料の衝撃緩衝性を調べるために下記の試験方法で落球テストを行った。また、比較のため、シリコーンバンシングパテを用いないウレタンスポンジの衝撃緩衝性も測定した。更に参考例としてシリコーンバンシングパテについても同様の測定を行った。結果を表1に併記する。

【0022】衝撃緩衝性評価試験方法

外径22mm、重さ45gの鋼球を12cm及び48cmの高さからそれぞれ5cm×5cm×5mmのアルミニウム板上に載せたサンプル（衝撃緩衝材料）上に落下させ、そのときにサンプルが受ける衝撃力をロードセル（共和（株）製、LU-200kg）で測定し、この測定信号を直流増幅器（UNIPULSE製、AM-30）に送出して約1,000倍に増幅し、この増幅値をアナライジングレコーダ（横河北辰電機製、Model 3655）に送出し、波形解析を行って波形を記録し、記録されたピークの値（最大衝撃力）から下記式により衝撃緩衝性を算出した。

【0023】なお、鋼球の衝突速度は、高さ12cmから鋼球を落下させた場合は1.53m/sec、高さ48cmからの場合は3.06m/sec、鋼球の運動量は、高さ12cmから鋼球を落下させた場合は0.069kgf・m/sec、高さ48cmからの場合は0.138kgf・m/secである。

【0024】

【数1】

$$\text{衝撃緩衝性 (\%)} = \frac{\text{ブランクの応力} - \text{サンプルの応力}}{\text{ブランクの応力}} \times 100$$

【0025】

【表1】

		実施例 1	比較例 1	実施例 2	比較例 2	実施例 3	比較例 3	実施例 4	比較例 4	実施例 5	比較例 5	実施例 6	比較例 6	参考例
ポリウレタン フォーム		MF-20		MF-30		MF-40		MF-50		MF-55		MF-80		-
セル数 (個/インチ)		20		30		40		50		55		80		-
比重*		0.08	0.03	0.27	0.03	0.26	0.03	0.34	0.03	0.34	0.05	0.40	0.08	1.12
衝撃緩 衝性 (%)	高さ 12cm	97	89	97	97	97	98	97	94	97	97	96	97	91
	高さ 48cm	62	20	90	44	91	32	93	31	93	45	94	59	91

*：実施例はポリウレタンフォームにシリコンバンシングパテをコーティングしたものの比重、比較例はポリウレタンフォームの比重、参考例はシリコンバンシングパテの比重を示す。

【0026】表1の結果から、実施例の衝撃緩衝材料は、大きい衝撃力が与えられた場合も十分な衝撃緩衝性を有し、しかも軽量化が図られたものであると共に、シリコンバンシングパテの特性が十分に発揮されたものであることがわかる。

【0027】

【発明の効果】本発明の衝撃緩衝材料は、穏やかな応力に対してはスムーズに変形し、これに追従すると共に、応力を取り除くと緩やかに原形に回復し、また、所定量以上の応力がかかったときには最小の変形で応力を緩和し、しかも軽量で所望の形状に形成することが容易で安価な衝撃緩衝材料となり、椅子、ヘルメット等の保護具などの衝撃緩衝性を付与する用途に好適なものである。

フロントページの続き

(72)発明者 松村 正章

群馬県碓氷郡松井田町大字人見1番地10

信越化学工業株式会社シリコン電子材料

技術研究所内

CLAIMS

[Claim(s)]

[Claim 1] The charge of impact shock absorbing material characterized by covering the frame grid front face of the flexible three-dimensions reticulum which has internal free passage space, or a form object, and coming to coat with silicone van SHINGUPATE.

[Claim 2] The charge of impact shock absorbing material according to claim 1 the above-mentioned three-dimensions reticulum or whose form object is plastic foam of open cell nature.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] The configuration imitation family name of this invention is good, and is excellent in impact emollience, and it relates to the charge of impact shock absorbing material which is used suitable for personal protective equipment, such as a chair and a helmet, etc. for this reason.

[0002]

[Description of the Prior Art] Conventionally, plastic foam, the Ayr mat, gel, putty, etc. are used as charges of impact shock absorbing material, such as personal protective equipment, such as a chair and a helmet. However, plastic foam and the Ayr mat are light, and while excelling in deformans and the flattery nature to a form, if strong impulse force is applied, will deform easily, and have the problem it becomes impossible to fully demonstrate buffer nature. On the other hand, although gel and putty have sufficient impact buffer nature also to comparatively strong impulse force, a problem is in lightweight-ization.

[0003] Then, in the charge of impact shock absorbing material and JP,4-117974,A which mixed the minute hollow object in gel in JP,62-159601,A, the charge of impact shock absorbing material which mixed the elastic minute hollow object in van SHINGUPATE is proposed as what attained lightweight-ization of gel or putty.

[0004] However, when the impact buffer member concerning these proposals has the inadequate flattery nature to a form, or becoming expensive since it needs a special package when it is going to equip a helmet, or forming in a request configuration further, it has problems, like a configuration has a limit.

[0005] This invention was made in view of the above-mentioned situation, also when the impulse force beyond a predetermined value is applied, can ease stress by the minimum deformation, and aims at offering the charge of impact shock absorbing material which can moreover be formed in a desired configuration while it is lightweight and the flattery nature to a form is good.

[0006]

[Means for Solving the Problem and its Function] In order that this invention person may attain the above-mentioned purpose, as a result of inquiring wholeheartedly, sinking-in processing of the flexible three-dimensions reticulum or flexible form object which has internal free passage space, such as plastic foam of open cell structure, is carried out with

the solution of silicone van SHINGUPATE. The charge of impact shock absorbing material obtained by covering the frame grid front face of the above-mentioned reticulum or a form object, and forming the coating layer of silicone van SHINGUPATE by the approach of making it dry etc. Where the above-mentioned internal free passage space is held, while the flattery nature to a form is good, a lightweight top The knowledge of the stress being certainly eased moreover enough, also when strong impulse force is applied, and excelling in impact buffer nature, and being able to form in a desired configuration easily is carried out, and it came to make this invention.

[0007] Therefore, this invention covers the frame grid front face of the flexible three-dimensions reticulum which has internal free passage space, or a form object, and offers the charge of impact shock absorbing material characterized by coming to coat with silicone van SHINGUPATE.

[0008] Hereafter, if this invention is explained further in full detail, the charge of impact shock absorbing material of this invention will use as a base the flexible reticulum or flexible form object which has internal free passage space.

[0009] Here, the porous matter which consists of fibrous material, such as quality of a porous natural product, such as plastic foam of the open cell structure of polyethylene, polystyrene, a polyvinyl chloride, polyurethane, phenol resin, a urea resin, methacrylic resin, and silicone resin, sponge, and a cork, textile fabrics, and a nonwoven fabric, as a reticulum or a form object is mentioned. In this, polyurethane foam and silicone foam are desirable, a class is also abundant in existing especially flexible elastic polyether polyurethane foam and polyester polyurethane foam, and they can use it suitably also in the plastic foam of open cell structure.

[0010] Although especially the number of cels is not restricted when it is the diameter or plastic foam of the above-mentioned internal free passage space, in the case of polyurethane foam, it is desirable to set the specific gravity to 0.03-0.08 from the point of the impregnating ability at the time of sinking in the silicone van SHINGUPATE solution mentioned later. Moreover, since it is the same, in the case of silicone foam, it is desirable to set the specific gravity to 0.1-0.5.

[0011] Silicone van SHINGUPATE consists of a siloxane containing a boron atom, and can be obtained by the manufacture approach indicated by JP,26-6944,B. It can obtain, when the viscosity in 25 degrees C specifically carries out the polymerization of the 90 to dimethylsiloxane 10 section which has the both-ends hydroxy group of 1-10,000cst, the 0.1 to way acid 15 section, and the zero to colloidal silica 20 section to the ten to dimethylsiloxane 90 section (it is the same the weight section and the following) in which the viscosity in 25 degrees C has the both-ends alkoxy group of one to 1,000 centistokes (cst) in 140-150 degrees C for 2 to 10 hours for example, in a kneader.

[0012] In addition, if this silicone van SHINGUPATE is lengthened gradually, an impact is given to elongation and this with a hammer etc. like a starch sirup, it is divided like glass and it is left, it deforms gradually, becomes plate-like, and it has the property to bounce well rather than a rubber bowl.

[0013] In this case, as a solvent which dissolves silicone van SHINGUPATE, polar solvents, such as alcohols, ester, ketones, hydrocarbons, and halogenated hydrocarbon, can be used, and ketones, such as ester, such as acetic ester, a methyl ethyl ketone, and methyl isobutyl ketone, are especially recommended from the soluble point of silicone van SHINGUPATE.

[0014] As for the amount of these solvents used to silicone van SHINGUPATE, it is desirable to consider as the 20 to 400 section to the silicone van SHINGUPATE 100 section.

[0015] Such a solution is infiltrated into the above-mentioned reticulum or form objects, such as plastic foam. When forming the coating layer of silicone van SHINGUPATE in the frame grid front face of a reticulum or a form object It pulls up, after fully infiltrating the above-mentioned solution into the internal free passage space of the above-mentioned reticulum or a form object by immersing the above-mentioned solution in this reticulum or a form object. If the approach of squeezing out an excessive solution with a roll, a reticulum, or a form object is a split, the above-mentioned solution to both sides A roll coater, The approach of fully applying by a knife coating machine etc. (spreading sinking into the interior of a reticulum or a form object in the above-mentioned solution) can be adopted, and, subsequently the charge of impact shock absorbing material of this invention can be obtained by making it dry at room temperature -100 degree C for 2 minutes to one day.

[0016] In this case, although the amount of coatings of silicone van SHINGUPATE can be decided according to the application of the charge of impact shock absorbing material, it is desirable to consider as an amount from which the specific gravity of the charge of impact shock absorbing material after the above-mentioned desiccation serves as the range of 0.1-0.8 generally. Since the amount of formation of silicone van SHINGUPATE has too little this specific gravity less than 0.1, if sufficient impact buffer effect may not be obtained and this specific gravity exceeds 0.8, lightweight-ization of the goods equipped with the charge of impact shock absorbing material may not fully accomplish.

[0017] While the charge of impact shock absorbing material obtained as mentioned above deforms smoothly to quiet stress and following this When stress was removed, it recovers to the original form gently and the stress more than the specified quantity is applied, stress is eased by the minimum deformation. And it is lightweight and suitable for the application which forming in a desired configuration becomes an easy and cheap charge of impact shock absorbing material, and gives impact buffer nature, such as personal protective equipment, such as a chair and a helmet, for this reason.

[0018]

[Example] Although an example and the example of a comparison are shown and this invention is explained concretely hereafter, this invention is not restricted to the following example.

[0019] [examples 1-6 and the examples 1-6 of a comparison] -- the polymerization of the dimethylsiloxane 30 section which first has the both-ends hydroxy group of the viscosity as the above with the viscosity same in the dimethylsiloxane 70 section which has the both-ends ethoxy radical of 10 centistokes in 25 degrees C, the way acid 5.5 section, and the colloidal silica 3 section, was carried out at 140-150 degrees C in the kneader for 4 hours, and silicone van SHINGUPATE was obtained. Subsequently, the ethyl-acetate 100 section was added to this silicone van SHINGUPATE 100 section, it dissolved by the mixer, and sinking-in liquid was prepared.

[0020] The above-mentioned sinking-in liquid was sunk into the urethane sponge (1cm in the polyurethane foam of made in Iso AKKU corporation and MF series, 5cm long, 5cm wide, thickness) shown in Table 1 by 5mm of roll **** with 2 rolls, it was left in the room temperature for 3 hours, and the charge of impact shock absorbing material was

obtained by subsequently drying for 30 minutes at 80 degrees C.

[0021] In order to investigate the impact buffer nature of the charge of these impacts shock absorbing material, the drop test was performed with the following test method. Moreover, the impact buffer nature of urethane sponge which does not use silicone van SHINGUPATE was also measured for the comparison. Furthermore, measurement with the same said of silicone van SHINGUPATE as an example of reference was performed. A result is written together to Table 1.

[0022] It is made to fall on the sample (charge of impact shock absorbing material) which carried 22mm of diameters of method of impact buffer nature evaluation trial extraordinary, and a shot with a weight of 45g on the 5cmx5cmx5mm aluminum plate from height of 12cm and 48cm, respectively. The impulse force which a sample receives then is measured by the load cell (made in Kyowa, LU-200kg). Send out this measurement signal to DC amplifier (the product made from UNIPULSE, AM-30), and it amplifies about 1,000 times. This magnification value was sent out to the ANARAI zinc recorder (horizontal Kahoku a dragon the product made from electrical machinery, Model3655), waveform analysis was performed, the wave was recorded, and impact buffer nature was computed by the following type from the value (the maximum impulse force) of the recorded peak.

[0023] In addition, when the collision rate of a shot drops a shot from height of 12cm and the momentum of 3.06 m/sec and a shot drops [case / from 1.53 m/sec and height of 48cm] a shot from height of 12cm, the cases from 0.069 kgf-m/sec and height of 48cm are 0.138 kgf-m/sec.

[0024]

[Equation 1]

$$\text{衝撃緩衝性 (\%)} = \frac{\text{ブランクの応力} - \text{サンプルの応力}}{\text{ブランクの応力}} \times 100$$

[0025]

[Table 1]

		実施例 1	比較例 1	実施例 2	比較例 2	実施例 3	比較例 3	実施例 4	比較例 4	実施例 5	比較例 5	実施例 6	比較例 6	参考例
ポリウレタン フォーム		MF-20		MF-30		MF-40		MF-50		MF-55		MF-80		-
セル数 (個/インチ)		20		30		40		50		55		80		-
比重*		0.08	0.03	0.27	0.03	0.26	0.03	0.34	0.03	0.34	0.05	0.40	0.08	1.12
衝撃緩衝性 (%)	高さ 12cm	97	89	97	97	97	98	97	94	97	97	96	97	91
	高さ 48cm	62	20	90	44	91	32	93	31	93	45	94	59	91

* : although the example coated polyurethane foam with silicone van SHINGUPATE, as for the specific gravity of polyurethane foam, and the example of reference, specific gravity and the example of a comparison show the specific gravity of silicone van SHINGUPATE.

[0026] While the charge of impact shock absorbing material of an example has sufficient impact buffer nature also when large impulse force is given, and lightweight-ization is moreover attained from the result of Table 1, it turns out that the property of silicone van SHINGUPATE is fully demonstrated.

[0027]

[Effect of the Invention] While the charge of impact shock absorbing material of this invention deforms smoothly to quiet stress and following this When stress was removed, it recovers to the original form gently and the stress more than the specified quantity is applied, stress is eased by the minimum deformation. And it is lightweight and suitable for the application which forming in a desired configuration becomes an easy and cheap charge of impact shock absorbing material, and gives impact buffer nature, such as personal protective equipment, such as a chair and a helmet.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] The configuration imitation family name of this invention is good, and is excellent in impact emollience, and it relates to the charge of impact shock absorbing material which is used suitable for personal protective equipment, such as a chair and a helmet, etc. for this reason.

EFFECT OF THE INVENTION

[Effect of the Invention] While the charge of impact shock absorbing material of this invention deforms smoothly to quiet stress and following this When stress was removed, it recovers to the original form gently and the stress more than the specified quantity is applied, stress is eased by the minimum deformation. And it is lightweight and suitable for the application which forming in a desired configuration becomes an easy and cheap charge of impact shock absorbing material, and gives impact buffer nature, such as personal protective equipment, such as a chair and a helmet.

TECHNICAL PROBLEM

[Description of the Prior Art] Conventionally, plastic foam, the Ayr mat, gel, putty, etc. are used as charges of impact shock absorbing material, such as personal protective equipment, such as a chair and a helmet. However, plastic foam and the Ayr mat are light, and while excelling in deformans and the flattery nature to a form, if strong impulse force is applied, will deform easily, and have the problem it becomes impossible to fully demonstrate buffer nature. On the other hand, although gel and putty have sufficient impact buffer nature also to comparatively strong impulse force, a problem is in lightweight-ization.

[0003] Then, in the charge of impact shock absorbing material and JP,4-117974,A which

mixed the minute hollow object in gel in JP,62-159601,A, the charge of impact shock absorbing material which mixed the elastic minute hollow object in van SHINGUPATE is proposed as what attained lightweight-ization of gel or putty.

[0004] However, when the impact buffer member concerning these proposals has the inadequate flattery nature to a form, or becoming expensive since it needs a special package when it is going to equip a helmet, or forming in a request configuration further, it has problems, like a configuration has a limit.

[0005] This invention was made in view of the above-mentioned situation, also when the impulse force beyond a predetermined value is applied, can ease stress by the minimum deformation, and aims at offering the charge of impact shock absorbing material which can moreover be formed in a desired configuration while it is lightweight and the flattery nature to a form is good.

OPERATION

[Means for Solving the Problem and its Function] In order that this invention person may attain the above-mentioned purpose, as a result of inquiring wholeheartedly, sinking-in processing of the flexible three-dimensions reticulum or flexible form object which has internal free passage space, such as plastic foam of open cell structure, is carried out with the solution of silicone van SHINGUPATE. The charge of impact shock absorbing material obtained by covering the frame grid front face of the above-mentioned reticulum or a form object, and forming the coating layer of silicone van SHINGUPATE by the approach of making it dry etc. Where the above-mentioned internal free passage space is held, while the flattery nature to a form is good, a lightweight top The knowledge of the stress being certainly eased moreover enough, also when strong impulse force is applied, and excelling in impact buffer nature, and being able to form in a desired configuration easily is carried out, and it came to make this invention.

[0007] Therefore, this invention covers the frame grid front face of the flexible three-dimensions reticulum which has internal free passage space, or a form object, and offers the charge of impact shock absorbing material characterized by coming to coat with silicone van SHINGUPATE.

[0008] Hereafter, if this invention is explained further in full detail, the charge of impact shock absorbing material of this invention will use as a base the flexible reticulum or flexible form object which has internal free passage space.

[0009] Here, the porous matter which consists of fibrous material, such as quality of a porous natural product, such as plastic foam of the open cell structure of polyethylene, polystyrene, a polyvinyl chloride, polyurethane, phenol resin, a urea resin, methacrylic resin, and silicone resin, sponge, and a cork, textile fabrics, and a nonwoven fabric, as a reticulum or a form object is mentioned. In this, polyurethane foam and silicone foam are desirable, a class is also abundant in existing especially flexible elastic polyether polyurethane foam and polyester polyurethane foam, and they can use it suitably also in the plastic foam of open cell structure.

[0010] Although especially the number of cels is not restricted when it is the diameter or plastic foam of the above-mentioned internal free passage space, in the case of polyurethane foam, it is desirable to set the specific gravity to 0.03-0.08 from the point of

the impregnating ability at the time of sinking in the silicone van SHINGUPATE solution mentioned later. Moreover, since it is the same, in the case of silicone foam, it is desirable to set the specific gravity to 0.1-0.5.

[0011] Silicone van SHINGUPATE consists of a siloxane containing a boron atom, and can be obtained by the manufacture approach indicated by JP,26-6944,B. It can obtain, when the viscosity in 25 degrees C specifically carries out the polymerization of the 90 to dimethylsiloxane 10 section which has the both-ends hydroxy group of 1-10,000cst, the 0.1 to way acid 15 section, and the zero to colloidal silica 20 section to the ten to dimethylsiloxane 90 section (it is the same the weight section and the following) in which the viscosity in 25 degrees C has the both-ends alkoxy group of one to 1,000 centistokes (cst) in 140-150 degrees C for 2 to 10 hours for example, in a kneader.

[0012] In addition, if this silicone van SHINGUPATE is lengthened gradually, an impact is given to elongation and this with a hammer etc. like a starch sirup, it is divided like glass and it is left, it deforms gradually, becomes plate-like, and it has the property to bounce well rather than a rubber bowl.

[0013] In this case, as a solvent which dissolves silicone van SHINGUPATE, polar solvents, such as alcohols, ester, ketones, hydrocarbons, and halogenated hydrocarbon, can be used, and ketones, such as ester, such as acetic ester, a methyl ethyl ketone, and methyl isobutyl ketone, are especially recommended from the soluble point of silicone van SHINGUPATE.

[0014] As for the amount of these solvents used to silicone van SHINGUPATE, it is desirable to consider as the 20 to 400 section to the silicone van SHINGUPATE 100 section.

[0015] Such a solution is infiltrated into the above-mentioned reticulum or form objects, such as plastic foam. When forming the coating layer of silicone van SHINGUPATE in the frame grid front face of a reticulum or a form object It pulls up, after fully infiltrating the above-mentioned solution into the internal free passage space of the above-mentioned reticulum or a form object by immersing the above-mentioned solution in this reticulum or a form object. If the approach of squeezing out an excessive solution with a roll, a reticulum, or a form object is a split, the above-mentioned solution to both sides A roll coater, The approach of fully applying by a knife coating machine etc. (spreading sinking into the interior of a reticulum or a form object in the above-mentioned solution) can be adopted, and, subsequently the charge of impact shock absorbing material of this invention can be obtained by making it dry at room temperature -100 degree C for 2 minutes to one day.

[0016] In this case, although the amount of coatings of silicone van SHINGUPATE can be decided according to the application of the charge of impact shock absorbing material, it is desirable to consider as an amount from which the specific gravity of the charge of impact shock absorbing material after the above-mentioned desiccation serves as the range of 0.1-0.8 generally. Since the amount of formation of silicone van SHINGUPATE has too little this specific gravity less than 0.1, if sufficient impact buffer effect may not be obtained and this specific gravity exceeds 0.8, lightweight-ization of the goods equipped with the charge of impact shock absorbing material may not fully accomplish.

[0017] While the charge of impact shock absorbing material obtained as mentioned above deforms smoothly to quiet stress and following this When stress was removed, it recovers to the original form gently and the stress more than the specified quantity is applied,

stress is eased by the minimum deformation. And it is lightweight and suitable for the application which forming in a desired configuration becomes an easy and cheap charge of impact shock absorbing material, and gives impact buffer nature, such as personal protective equipment, such as a chair and a helmet, for this reason.

EXAMPLE

[Example] Although an example and the example of a comparison are shown and this invention is explained concretely hereafter, this invention is not restricted to the following example.

[0019] [examples 1-6 and the examples 1-6 of a comparison] – the polymerization of the dimethylsiloxane 30 section which first has the both-ends hydroxy group of the viscosity as the above with the viscosity same in the dimethylsiloxane 70 section which has the both-ends ethoxy radical of 10 centistokes in 25 degrees C, the way acid 5.5 section, and the colloidal silica 3 section was carried out at 140-150 degrees C in the kneader for 4 hours, and silicone van SHINGUPATE was obtained. Subsequently, the ethyl-acetate 100 section was added to this silicone van SHINGUPATE 100 section, it dissolved by the mixer, and sinking-in liquid was prepared.

[0020] The above-mentioned sinking-in liquid was sunk into the urethane sponge (1cm in the polyurethane foam of made in Iso AKKU corporation and MF series, 5cm long, 5cm wide, thickness) shown in Table 1 by 5mm of roll **** with 2 rolls, it was left in the room temperature for 3 hours, and the charge of impact shock absorbing material was obtained by subsequently drying for 30 minutes at 80 degrees C.

[0021] In order to investigate the impact buffer nature of the charge of these impacts shock absorbing material, the drop test was performed with the following test method. Moreover, the impact buffer nature of urethane sponge which does not use silicone van SHINGUPATE was also measured for the comparison. Furthermore, measurement with the same said of silicone van SHINGUPATE as an example of reference was performed. A result is written together to Table 1.

[0022] It is made to fall on the sample (charge of impact shock absorbing material) which carried 22mm of diameters of method of impact buffer nature evaluation trial extraordinary, and a shot with a weight of 45g on the 5cmx5cmx5mm aluminum plate from height of 12cm and 48cm, respectively. The impulse force which a sample receives then is measured by the load cell (made in Kyowa, LU-200kg). Send out this measurement signal to DC amplifier (the product made from UNIPULSE, AM-30), and it amplifies about 1,000 times. This magnification value was sent out to the ANARAI zinc recorder (horizontal Kahoku a dragon the product made from electrical machinery, Model3655), waveform analysis was performed, the wave was recorded, and impact buffer nature was computed by the following type from the value (the maximum impulse force) of the recorded peak.

[0023] In addition, when the collision rate of a shot drops a shot from height of 12cm and the momentum of 3.06 m/sec and a shot drops [case / from 1.53 m/sec and height of 48cm] a shot from height of 12cm, the cases from 0.069 kgf-m/sec and height of 48cm are 0.138 kgf-m/sec.

[0024]

[Equation 1]

$$\text{衝撃緩衝性 (\%)} = \frac{\text{ブランクの応力} - \text{サンプルの応力}}{\text{ブランクの応力}} \times 100$$

[0025]

[Table 1]

		実施例 1	比較例 1	実施例 2	比較例 2	実施例 3	比較例 3	実施例 4	比較例 4	実施例 5	比較例 5	実施例 6	比較例 6	参考例
ポリウレタン フォーム		MF-20		MF-30		MF-40		MF-50		MF-55		MF-80		-
セル数 (個/インチ)		20		30		40		50		55		80		-
比重*		0.08	0.03	0.27	0.03	0.26	0.03	0.34	0.03	0.34	0.05	0.40	0.08	1.12
衝撃緩衝性 (%)	高さ 12cm	97	89	97	97	97	98	97	94	97	97	96	97	91
	高さ 48cm	62	20	90	44	91	32	93	31	93	45	94	59	91

* : although the example coated polyurethane foam with silicone van SHINGUPATE, as for the specific gravity of polyurethane foam, and the example of reference, specific gravity and the example of a comparison show the specific gravity of silicone van SHINGUPATE.

[0026] While the charge of impact shock absorbing material of an example has sufficient impact buffer nature also when large impulse force is given, and lightweight-ization is moreover attained from the result of Table 1, it turns out that the property of silicone van SHINGUPATE is fully demonstrated.